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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/651,105	08/29/2003	Mamoru Nakasuji	2003_1217A	7747

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EXAMINER

LEYBOURNE, JAMES J

ART UNIT	PAPER NUMBER
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2881

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/651,105	Applicant(s) NAKASUJI ET AL.	
	Examiner James J. Leybourne	Art Unit 2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 31 January 2005.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-65 is/are pending in the application.
- 4a) Of the above claim(s) 27-53 and 63-65 is/are withdrawn from consideration.
- 5) ☒ Claim(s) 57 and 59 is/are allowed.
- 6) ☒ Claim(s) 1-8, 10-17, 19-26, 54-56, 58, 61 and 62 is/are rejected.
- 7) ☒ Claim(s) 9, 18 and 60 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>1/21/2004</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. According to the " RESPONSE TO RESTRICTION REQUIREMENT" received 31 January 2005, the invention of Group 1, claims 1-26 and 54-62, drawn to a projection transmission microscope was elected without traverse.

Claims 27-53 and 63-65 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 31 January 2005.

Abstract

2. The abstract exceeds 300 words.

Applicant is reminded of the proper language and format for an abstract of the disclosure.

The abstract should be in narrative form and generally limited to a single paragraph on a separate sheet within the range of 50 to 150 words. It is important that the abstract not exceed 150 words in length since the space provided for the abstract on the computer tape used by the printer is limited. The form and legal phraseology often used in patent claims, such as "means" and "said," should be avoided. The abstract should describe the disclosure sufficiently to assist readers in deciding whether there is a need for consulting the full patent text for details.

Claim Objections

3. In claim 9, line 4, the term "as measured" should be deleted or explained. It is unnecessary to the claim and implies that there is some technique or apparatus used to measure the area on the sample.
4. In claim 57, line 4, "whereina" should be "wherein a".
5. In claim 57, lines 4 and 5, "a" should be replaced by "said" or "the" to ensure clarity and "of electron " should have "said" or "the" inserted between "of" and "electron".

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claims 10, 16, 21, 22, 25, 54-56, 58 and 62 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 10 recites the limitation "said plurality of apertures" in line 5. There is insufficient antecedent basis for this limitation in the claim.

Claim 16 recites the limitation "said plurality of magnifying lenses" in line 3.

There is insufficient antecedent basis for this limitation in the claim.

Claim 21 cites changing a focal length of the lens and scanning the sample with a crossover image. The only lens cited in claims 20 and 1, from which claim 21 depends, is the lens for magnifying the transmitted beam (claim 1). Since this lens modifies the transmitted electrons, it is not clear how this can create a crossover image to scan the sample.

Regarding claim 22, the term "effective frequency of said system" is not clearly defined. The examiner infers that this is the pixel processing rate for an image. This requires clarification in the claim because the "effective frequency of a system" is subject to many interpretations within the art.

Claim 25 recites the limitation "irradiation section" in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim 54 does not clearly define what is conjugate to what. Does this refer to the electron gun and the NA, the electron gun and the sample, the NA and the sample or all three pairs? Claim, 58 and 62 are indefinite because they depend from claim 54.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1, 2, 4, 11, 12, 17, 23, 26 and 61 are rejected under 35 U.S.C. 102(b) as being anticipated by Ogasawara et al. (USPN 5923034).

Regarding claims 12, 17 and 23, in Fig. 2. Ogasawara et al. disclose a mask inspection apparatus comprising an electron gun for irradiating an electron beam onto a mask with a pattern formed thereon, an electron lens for magnifying an electro-optic mask image passed through the mask, and a detector comprising a fluorescent screen for converting the magnified electro-optic mask image to an optical mask image, an optical lens for optically magnifying the optical mask image, a light detector (MCP and CCD camera) for detecting the magnified optical mask image (abstract). A control unit **28** compares the image from the sensor to referenced data stored on tape **29**.

Regarding claim 2, the sample can be a stencil mask (column 3, line 44).

Regarding claim 4, an aperture **14** is used to shape the electron beam (column 3, line 54).

Regarding claim 11, a deflection coil **16** is so provided as to allow the X-ray mask **10** to be scanned with an electron beam **12** (column 3, lines 56-57).

Regarding claim 26, it is notoriously well known that mask inspection systems are used in manufacturing semiconductor devices.

Regarding claim 61, it is inherent in electron optics systems that the distance between the image and an object of the image depends on the magnification ratio.

8. Claims 1-5, 13, 20 and 24-26 are rejected under 35 U.S.C. 102(b) as being anticipated by Sogard (US2003/0132382 A1).

In Fig. 1A, Sogard discloses a mask inspection system for inspecting a mask [0039]. The mask **101** illustrated in FIG. 1A can be a membrane stencil type mask [0042]. The inspection system **100** can include a beamlet supply assembly **111** (electron gun) and a lens element **114** (collimator) that directs the illumination downwardly in a generally collimated beam parallel to a system axis **104** towards the mask **101**. After interacting with the mask **101**, radiation from the beamlets is detected by the detector assembly **180** [0014]. FIG. 2 illustrates a beamlet shaping section of the inspection system shown in FIG. 1B. Apertures **202** form beamlets that are demagnified and directed onto the mask **101** by a lens group **112**.

Regarding claim 5, referring to FIG. 2, there are two aperture arrays that are optically conjugate [0047]. The formation of the beamlets in the beam shaping section **108** is illustrated. The collimated beam **200** is incident on the first multi-aperture array **116**. Those electrons passing through one of the apertures **202** of multi-aperture array **116** form a beamlet **204**. The shape of the beamlet **204** is discussed in conjunction with FIGS. 5A-5C. The beamlet **204** is re-imaged onto the second multi-aperture array **126** by the lens elements **122** and **124**. For each aperture **202** in the first multi-aperture array **116** there corresponds an aperture **208** in the second multi-aperture array **126**, so that each re-imaged beamlet from the first multi-aperture array **116** will pass through or partially pass (depends on overlap of the apertures) through a corresponding aperture **208** in the second multi-aperture array **126**.

Regarding claim 13, Sogard teaches possible examples of advanced cathodes that produce beamlets at each multi-aperture include field emitter sources that have very small source size. Some possible examples of advanced cathodes that produce beamlets at each multi-aperture location are p-n junction arrays, a photocathode illuminated with a periodic array of light beams, and field emitter arrays. Some possible examples of advanced cathodes that produce beamlets at each multi-aperture location are p-n junction arrays, a photocathode illuminated with a periodic array of light beams, and field emitter arrays [0056].

Regarding claim 20, a detector **186** is a backscattered electron (BSE) detector that measures the amount of electrons backscattered from the mask [0106].

9. Claim 19 is rejected under 35 U.S.C. 102(b) as being anticipated by Honjo et al. (USPN 5557105). In Fig. 2, Honjo et al. disclose a mask inspection apparatus wherein an electron image of mask 31 is projected on a detector **4**. The detector can be a multi channel plate **41**, illustrated in FIG. 6. The mask pattern thus formed can be obtained as a two dimensional image (column 8, lines 8-12).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said

subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

10. Claims 6, 8, 12, 14 and 56 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ogasawara et al. (USPN 5923034).

Regarding claim 6, Ogasawara et al. are silent on the type of source used for the charged particles, but cite that it can be an electron beam. One of ordinary skill in the art at the time of the invention would be motivated to select a thermionic, charge-limited electron source because it is well known in the art that conventional focused electron beam systems (such as the electron microscope) operate with thermionic cathodes.

Regarding claim 8, Ogasawara et al. do not teach that an image of the source is formed in the entrance pupil. It would be obvious to one of ordinary skill in the art to modify the illumination system of Ogasawara et al. to modify the condenser of Ogasawara et al. to image the source onto the entrance pupil to provide Koehler illumination because it is known that with Koehler illumination, a field with uniform illumination is obtained, circumscribed by the image of the field diaphragm.

Regarding claim 12, Ogasawara et al. do not teach that the ratio of the image size on the scintillator to the detector size is 1:1. It is well known in the art that the image size must be matched to the size of the detector. If the size of the image formed on the scintillator is the same as the size of the detector, it would be obvious to one of ordinary skill in the art to make the ratio of 1:1.

Regarding claim 14, Ogasawara et al. do not teach that the electron gun is disposed under the sample and the detector above the sample. This is simply a rearrangement of the parts of the inspection system.

In re Japikse, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950) Sifting the location of an element would not have modified the operation of device. In re Kuhle, 526 F.2d 553, 188 USPQ7 (CCPA 1975) The particular placement of an element was held to be obvious.

Ogasawara et al. disclose the claimed invention except for the rearrangement of the source and the detector. It would have been obvious to one having ordinary skill in the art at the time the invention was made to rearrange theses since it have been held that a mere rearrangement of element without modification of the operation of the device involves only routine skill in the art. One would have been motivated to rearrange the source and detector for the purpose of making interface of the electron beam system and another device such as an automatic loader station for masks to be inspected.

Regarding claim 56, Ogasawara et al. do not cite that the shaping aperture is in conjugate relation to the sample (i. e. focused on the sample). They state an electron beam **12** is emitted from an electron gun **11** and condensed by a condenser lens **13** on a shaped mask **14** where it is shaped into a rectangular or linear shape. The shaped beam **12** is irradiated by an objective lens 15 onto an X-ray mask **10**. A deflection coil **16** is so provided as to allow the X-ray mask **10** to be scanned with an electron beam

12. One of ordinary skill in the art would understand this to mean that the aperture is focused onto the sample.

11. Claims 7 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kojima (USPN 6441384 B1) in view of Ogasawara et al. (USPN 5923034). Kojima discloses a lithographic system that uses a two-stag Symmetric Magnetic Doublet (SMD) lens **10** electron lens (column 10, lines 19-21). He does not teach using a detector as the target in order to detect defects in the reticle. Ogasawara et al. teach projecting an image of a mask onto a detector to form a mask inspection apparatus.

It would be obvious to one of ordinary skill in the art to us the projection system of Kojima and a detector in place of the sample in order to inspect masks because Ogasawara et al. teach there is a growing demand is made to develop a mask inspection method using a charged particle beam, such as an electron beam for obtaining a higher resolution (column 1, lines 38-40).

Allowable Subject Matter

12. Claims 57 and 59 are allowed.

13. The following is an examiner's statement of reasons for allowance:

Regarding claim 57, the prior art fails to disclose or make obvious an electron beam system, in which an electron image of secondary electrons emanated from a sample surface, back scattering electrons or an electron having passed through the sample is magnified by an at least two-stage electron lens and then detected, wherein a

magnified image produced by a first stage of said electron lens is focused on a point upstream to a second stage of said electron lens to thereby reduce a distortion aberration or a magnification aberration.

Regarding claim 59, the prior art fails to disclose or make obvious an electron beam system that projects an image of a sample using electrons that pass through the sample onto a detector that forms a detected image and a distortion aberration in the detected image is simulated by calculation to thereby determine a difference between a third order of absolute value and a fifth order of absolute value of the distortion aberration, and a compensation parameter is optimized such that said difference is minimized or that the fifth order of absolute value is greater than the third order of absolute value by about 5 to 15 %.

14. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

15. Claims 9, 18 and 60 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

16. The following is a statement of reasons for the indication of allowable subject matter:

Regarding claim 9, the prior art fails to disclose or make obvious an electron beam system that projects an image of a sample using electrons that passes through

the sample wherein the magnification of a projection lens is variable in based on the area on the sample to be projected.

Regarding claim 18, the prior art fails to disclose or make obvious an electron beam system that projects an image of a sample using electrons that pass through the sample onto a scintillator and an optical system comprising a lens that projects an image of the scintillator screen onto a detector wherein said optical lens and detector are disposed in a vacuum.

Regarding claim 60, the prior art fails to disclose or make obvious an electron beam system that projects an image of a sample using electrons that pass through the sample onto a detector that forms a detected image and a distortion aberration in the detected image is simulated by calculation to thereby determine a difference between a third order of absolute value and a fifth order of absolute value of the distortion aberration, and a compensation parameter is optimized such that said difference is minimized or that the fifth order of absolute value is greater than the third order of absolute value by about 5 to 15 %.

Relevant Prior Art

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Leung et al. (US 20040036032 A1) compare thermionic electron sources with plasma electron sources.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to James J. Leybourne whose telephone number is (571) 272-2478. The examiner can normally be reached on M-F 9:00- 6:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R. Lee can be reached on (571) 272-2477. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

June 19, 2005

JJL


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